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Carbon budget allocation at local scale

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United Nations
Framework Convention on
Climate Change

Local climate finance for a just transition to carbon neutral and resilient cities

Side event– UNFCCC COP30 – Nov 11, 2025



Carbon budget allocation at local scale

- Global carbon budget – a concept relevant for policy evaluation
- Allocation at local scale – criteria to ensure fairness
- Results for selected regions – allowing for target evaluation

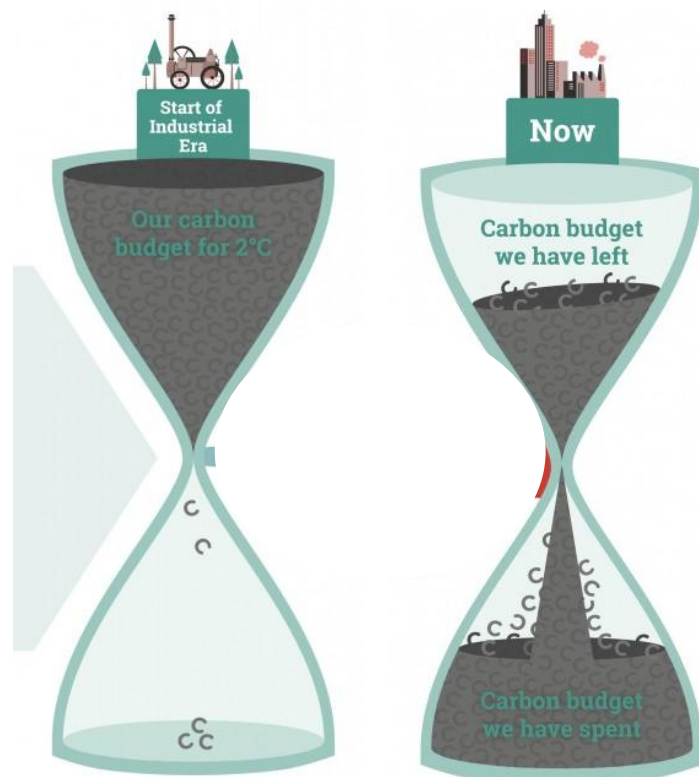
Carbon budgets



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Source: University of Cambridge, Program for Sustainability and Leadership

Carbon budget

= total amount of CO₂ that may be emitted worldwide during all time to come, such that

- with a specific likelihood
- global warming is limited to below 1.5C / 2C

GHG budget

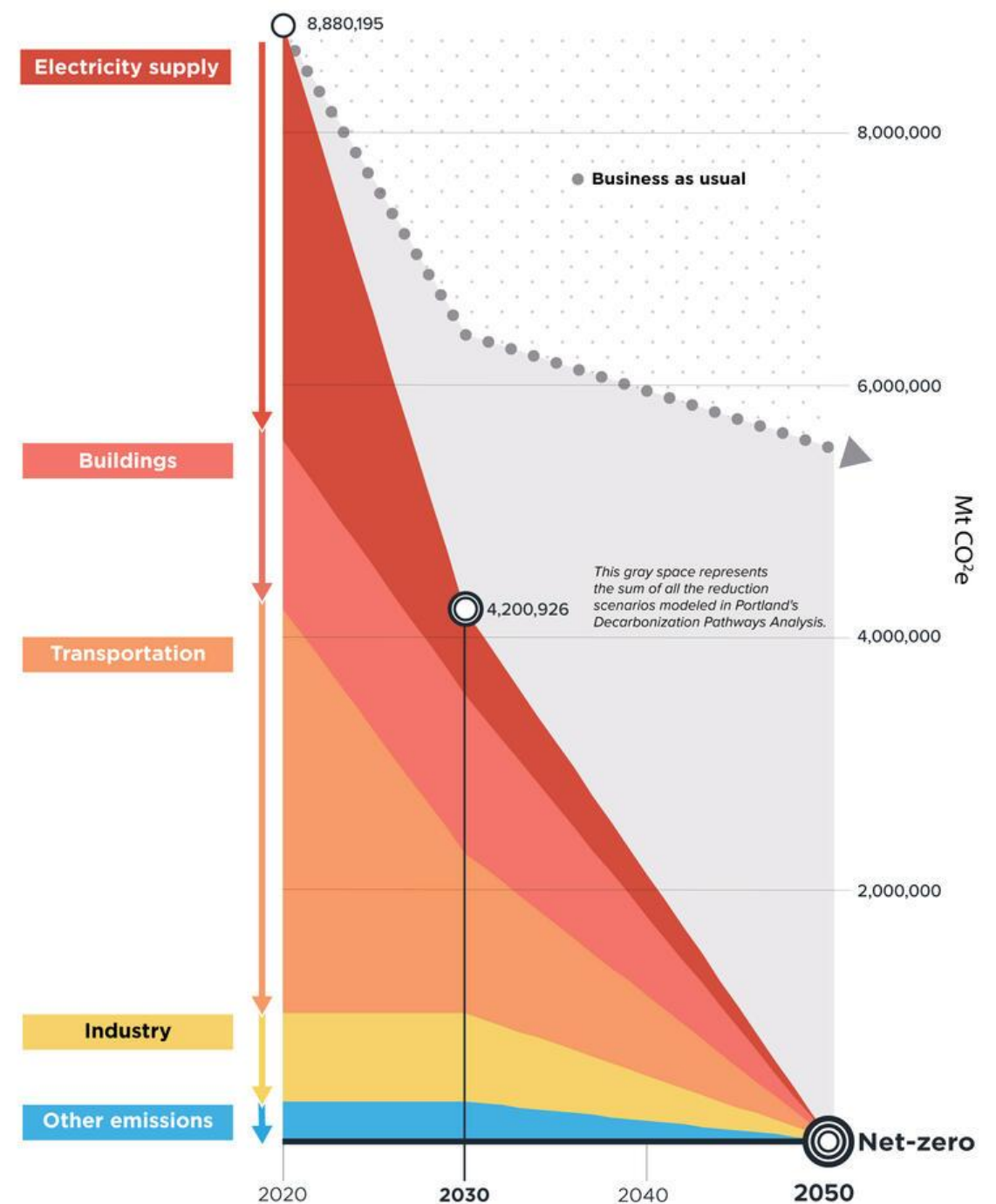
= total amount of GHGs

Net zero targets....

.... need to be consistent with a fair share in national/global carbon budget

- Example: City of Portland

To motivate financial resources
- prove that city emission reduction plans are not „grabbing carbon budget“ but are just, according to objective fairness criteria





Fair division of global carbon budget

- across nations: well studied / rich literature
- new work (forthcoming in Nature Communications):
 - Distributive **justice framework** for allocating national budget among subnational regions
 - **Basis: individuals' equal claims** to well-being benefits from emissions-generating activities
 - Distinction between **consumption- and production-based** emissions budgets
 - **Application** of framework to the EU (NUTS2 regions)
 - **Informs** political processes **and guides** equitable carbon-neutral transformations

Allocation at local scale

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Fair division of global carbon budget

both activities

- **production** and
- **consumption**

are uniquely **tied to wellbeing and** generate **emissions**

production-based emissions (PBE): emissions within territory (UNFCCC system)

consumption-based emissions (CBE): attribute emissions (occurring anywhere along the global supply chain) to the final consumer (i.e. households consuming and government or firms investing in capital stock), regardless of where they are physically emitted



Fair division of global carbon budget

- Allocation principles:
- For **consumption-based** emissions: qualified equal-per-capita allocation that accounts for
 - regional basic needs
 - historical responsibility, and
 - benefits from past emissions.
- For **production-based** emissions: Equal Transition Opportunity Production- Based Allocation (ETOPA) mechanism, which accounts for
 - heterogeneous regional economic structures and transition risks

ETOPA **estimates the committed PBE** of each sector in each region, defined as emissions expected **over the remaining lifetime of the existing capital stock**. If total committed PBE exceed the national budget, regions receive shares proportional to their committed emissions. If total emissions remain within the national budget, the latter is distributed equally per capita.

Fair division of carbon budget

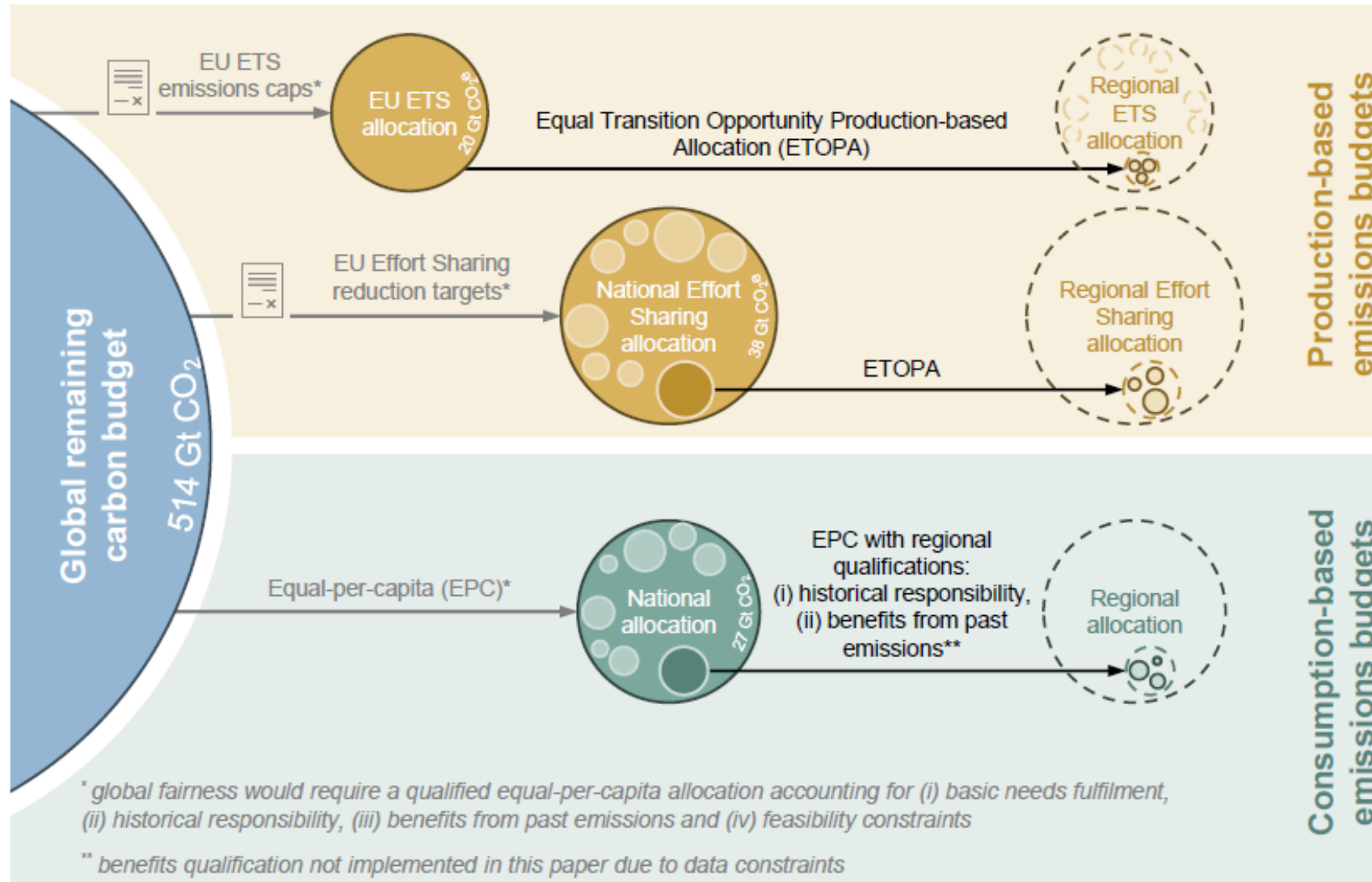


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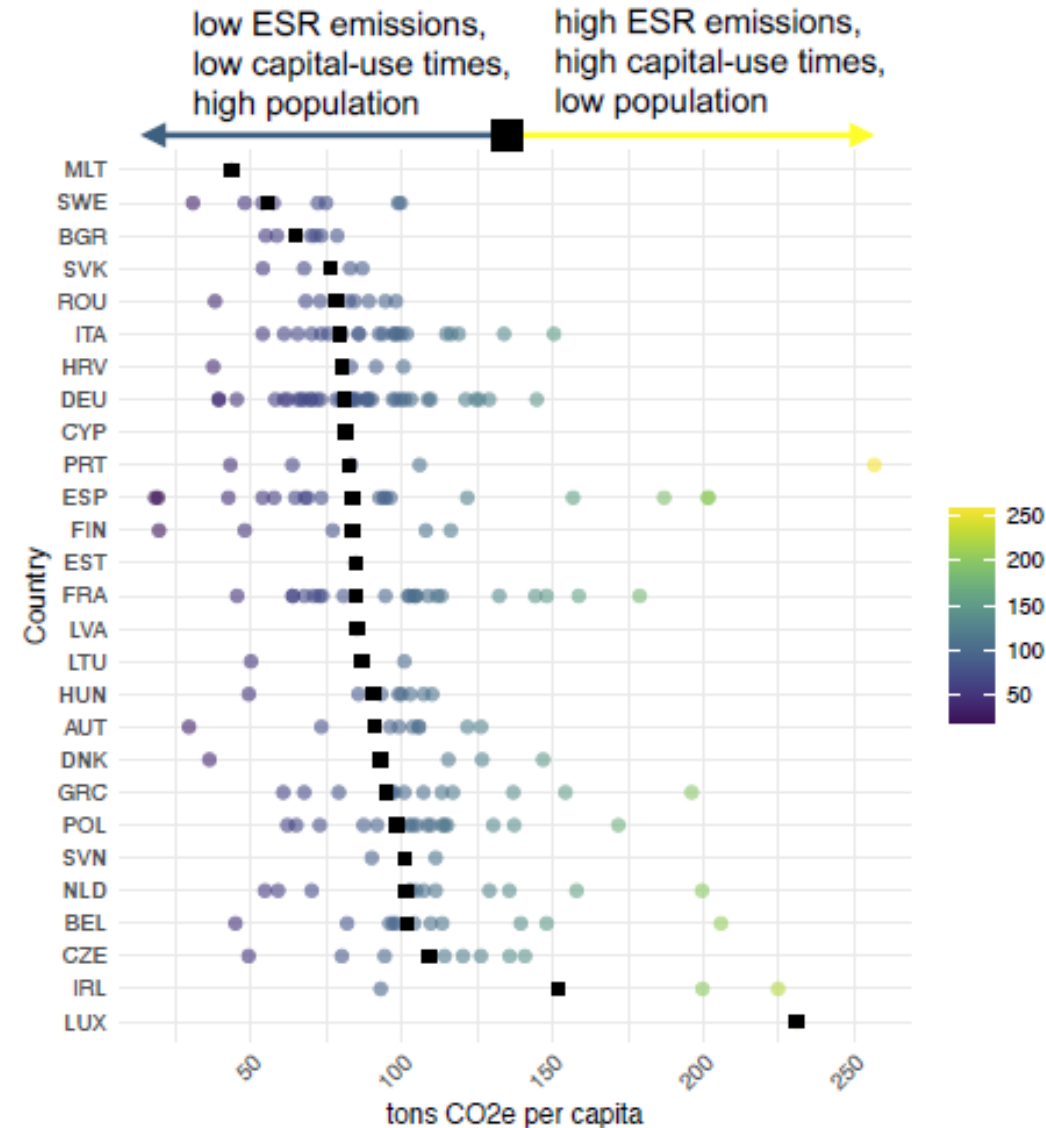
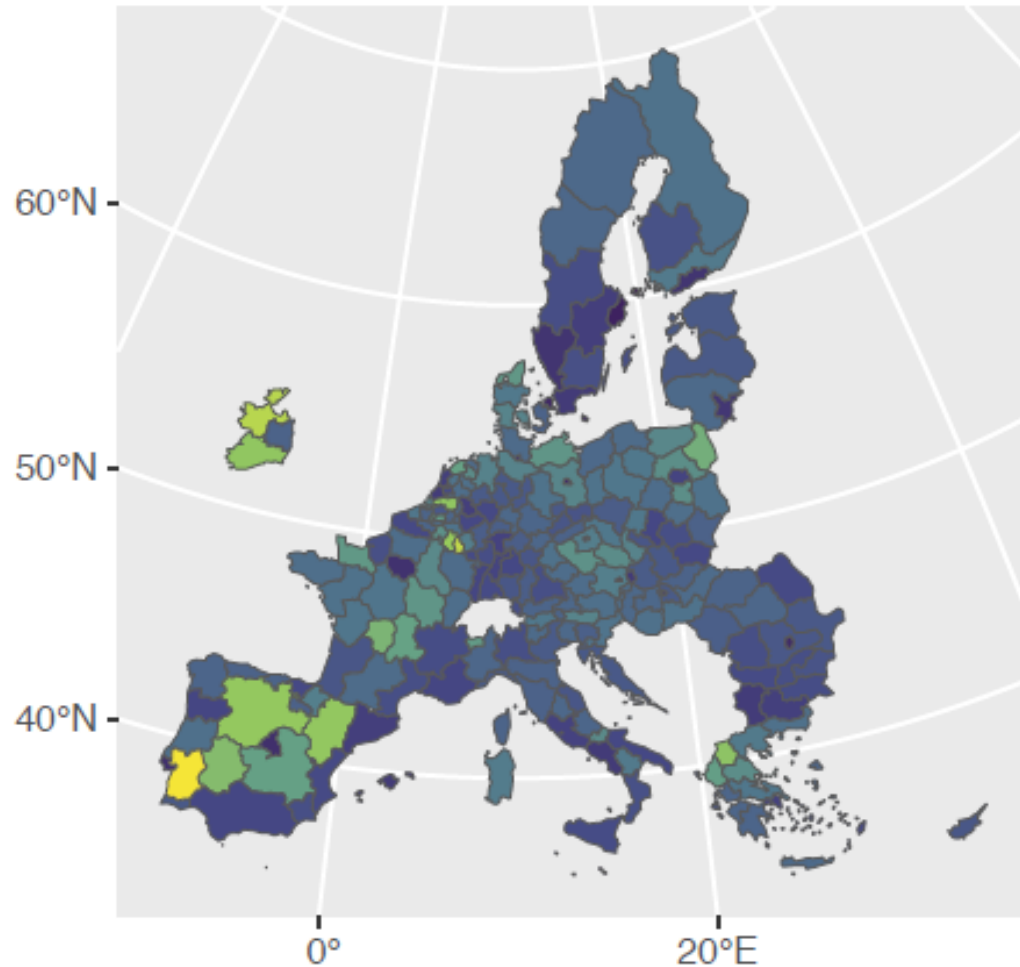
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Results (PBE, effort sharing ES)



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Results (CBE)



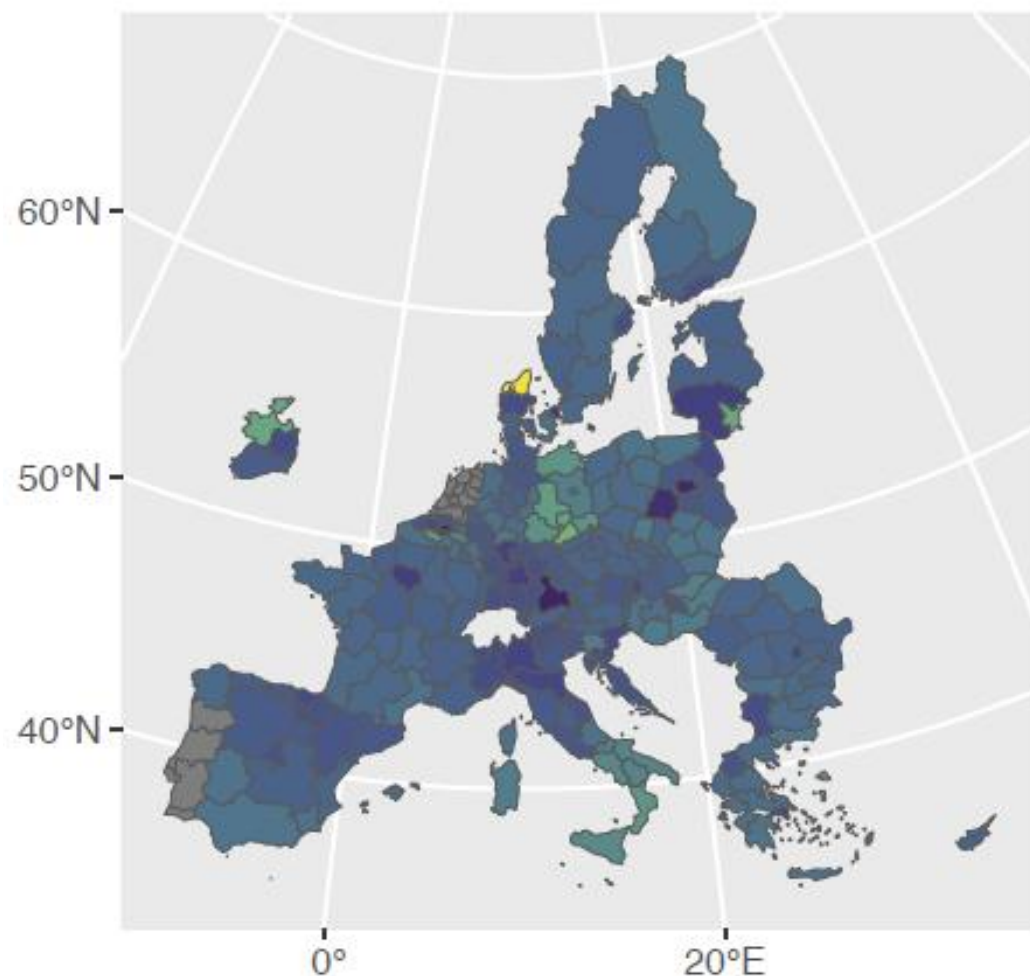
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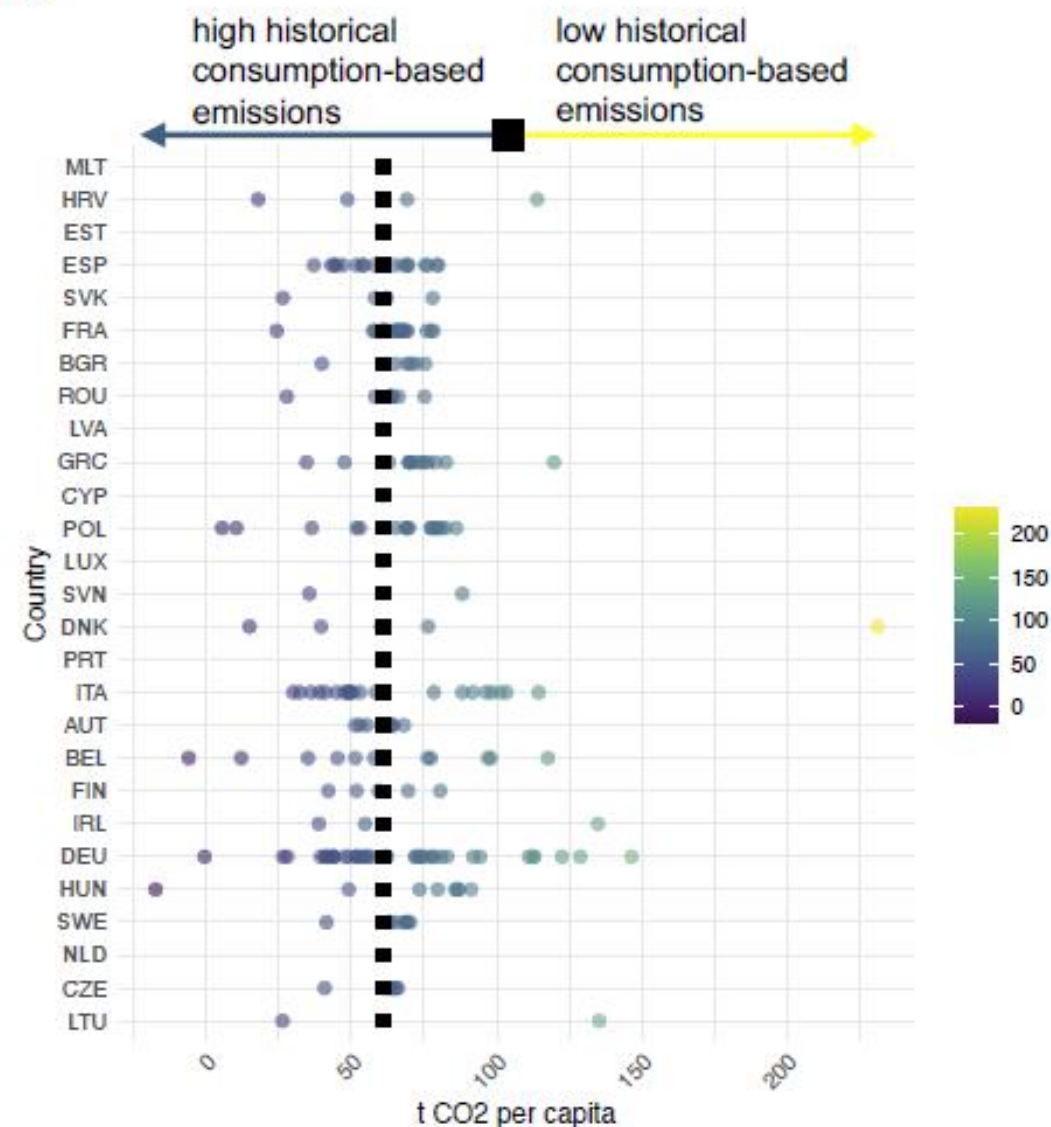
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a



b



Results

- Global carbon budget – a concept relevant for policy evaluation
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- **Results for selected regions – allowing for target evaluation**

Comparing net zero targets with fair carbon budgets



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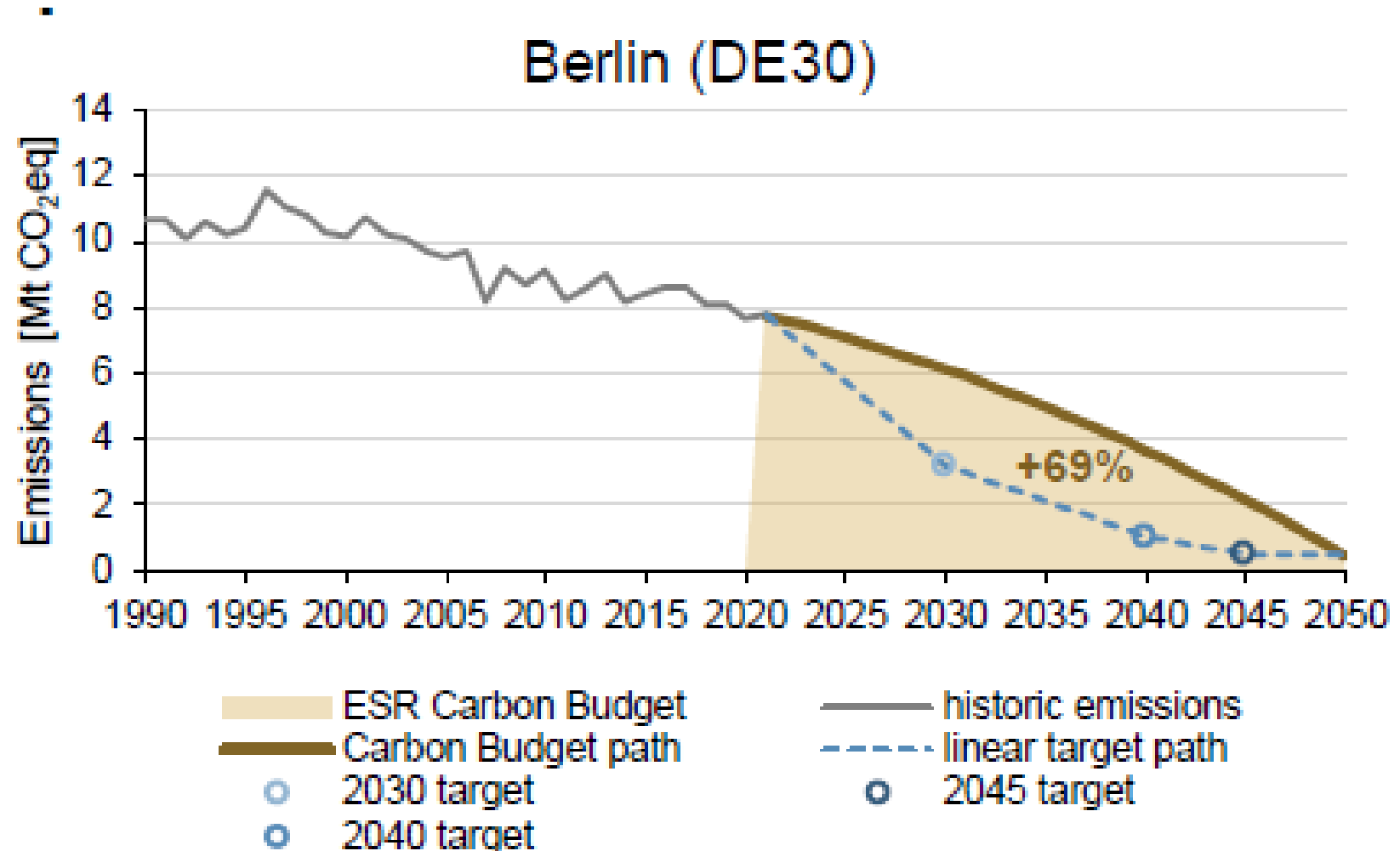


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Production-
based

Targets from:
Net Zero Tracker



Comparing net zero targets with fair carbon budgets



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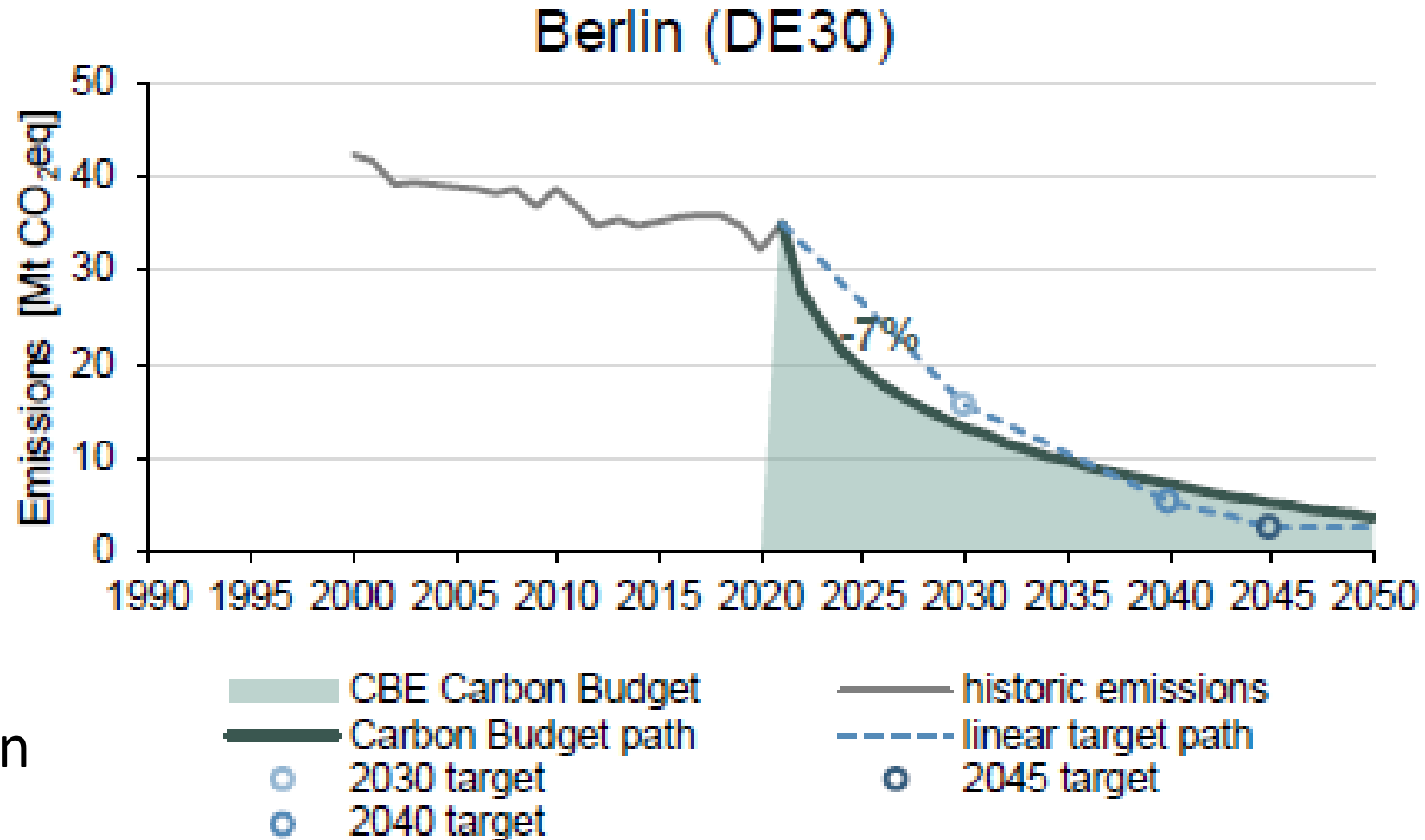


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Consumption-
based

Targets:
illustrative
„what-if“
equivalent to
production-
based reduction
target





Generalization

- Empirical illustration here done for EU
- Framework **can be operationalized for other countries**, e.g. the US, Canada or China
- (a) framework is **flexible** enough to account **for multi-layered regulation** structures which are also prevalent in China, where national and subnational ETSs coexist (for EU: distinction between PBE regulated by the EU-ETS and ESR)
- (b) Increasing **availability of subnational CBE data** and knowledge about their determinants in the US pave the way for discussion about subnational burden-sharing; our framework can serve as a starting point
- (c) In developing countries like India, where **a large share of states and union territories are below reasonable sufficiency thresholds** for wellbeing => basic needs fulfillment is central concern (explicitly addressed in this framework)

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